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THE BIOLOGICAL AND SOCIAL EFFECTS OF FISH FARMING ON THE FINNISH COAST

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By Erland Eklund, M.Pol.Sc.

Fish farming in Finland is currently expanding vigorously. An increasing amount of consumer fish is cultured fish. Very little is still known about the effects of fish farming on the waters and island communities of the coastal areas. The following article will outline the concept of an interdisciplinary research project into the effects of fish farming on the coastal areas of Finland. The project is managed by the Archipelagic Institute of Turku. The Environmental Science Committee of the Finnish Academy has granted funds for a more detailed preliminary study of this problem. The study will be carried out by Mr. Erland Eklund, M.Pol.Sc., Prof. Bo-Jungar Wikgren from the Institute of Biology of Aabo Academy is in charge of the project.

*Numbers in the right-hand margin indicate the corresponding page numbers in the original. Translator's note.

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1. BACKGROUND

Up to the 1970s, Finnish fish farming consisted primarily of the farming of stocking fingerlings to be cultured in the water system. In the 1970s, however, rainbow trout farming in net cages or enclosures gathered increasing momemtum. The fish are fed on dry feed products and gutting refuse until they have achieved a size suitable for consumption. The following figures reflect the speed of the increase: the annual production of rainbow trout was 1800 tonnes in 1975 and about 5000 tonnes in 1981. The value of rainbow trout was almost 100 million marks in 1981, which is 22 per cent of the total value of fishing that year. It can be calculated that, in a few years' time, about half of marketed fish will be cultured, if the planned expansion measures are implemented.

During the last few years, an adjustment has at the same time taken place regarding fish farming sites. An increasing number of fish farms are locating in the marine areas of our coasts, which is due to factors such as restrictions put into effect in the inland water areas, which in turn is due to manifestations of considerable pollution.

The future significance of fish farming as an important social issue is also shown by the fact that the Ministry of Agriculture and Forestry appointed a committee in 1981 to study how the harmful environmental impact of fish farming could be prevented. The report was published in 1982 (Nr. 12/82) (1). In April 1983, a working group was appointed to prepare more detailed rules for environmental pollution control within fish farming.

Kirjolohen kasvatus verkkoaltaissa.

Rainbow trout culture in net cages.

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2. FISH FARMING AS A BIOLOGICAL AND SOCIAL SUBJECT OF RESEARCH: SOME THEORETICAL APPROACHES

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It can be said that **a fundamental technological breakthrough** is taking place in fish farming. This breakthrough will to all appearances completely change the exploitation of water systems and the conditions of the entire fishing industry in Finland.

The objective of the study is to carry out an interdisciplinary investigation into the effects of this technological breakthrough.

2.1. The approach is humanist-ecological:

Fish farming (and other forms of exploitation concerning water) is an excellent example of the concept of "ecological transition", i.e. the process during which man and communities created by him work increasingly large parts of nature (natural ecosystems) into an

intensive production system controlled by man. Up to now, man has practiced fishing, more specifically traditional fishing, inefficiently by "collecting" species that have spread in nature and are produced by it. Large-scale fish farming heralds the beginning of a new era as far as the exploitation of water systems for man's own use is concerned. It could perhaps be said that the utility principle will be applied to a new element: water systems as a resource are brought into an intensive production system in which many factors are controlled by man.

The concept of ecological transition can in this case also be described by the definition TECHNOLOGICAL PARADIGM (3), which emphasizes the fact that we are dealing both with the adoption of a new technology and with the implementation of a new organizational plan within the fishing industry, which makes the changes important to society at large.

2.2. Assessment and monitoring of the technology

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Studies on technical changes have previously often concentrated on examining how new inventions spread. Such studies were often based on the undisputed assumption that inventions, technical changes as such, are useful or that they represent more advanced know-how (a kind of evolutionary view). Studies on inventions have thus extensively discussed what interest groups transmit new technology and what the rate of spreading is.

It can be said that a certain paradigmatic change has taken place in this field in the 1970s. The term TECHNOLOGY ASSESSMENT can be used as a blanket term for the new trend. The basic idea is that a technical change brings along both favourable and unfavourable changes. The outcome depends on the level that we are dealing with at any given time.

Relatively extensive experience has been gained in the U.S.A. on the harmful environmental effects of individual construction and industrial projects with the help of a method called the ENVIRONMENTAL IMPACT STATEMENT. This research method must by law be applied to all major projects using government grants there.

In Scandinavia, the Futurology Secretariat of Stockholm in particular took the pioneering step of incorporating the concept of technological assessment into its research (4).

3. BIOLOGICAL PROBLEMS ASSOCIATED WITH WATER

The very vigorous growth of fish farming in coastal waters described above is currently taking place mostly without any research into its biological effects on water. Our knowledge is slight in most areas, but the following in particular can be emphasized:

3.1. Diseases of cultured fish

Fish farming in our country was spared difficult diseases for a long time. Today's situation is not particularly bright any longer. A couple of bacterial diseases (vibriosis, contagious dermatitis) have spread yearly into increasingly wide fish farming areas in the archipelago at the same time that treatment has become more difficult because of the occurrence of resistant species of bacteria. The increasing use of antibiotics is becoming problematic in terms of environmental protection and even in terms of human medicine.

Judging by experiences elsewhere, we must unfortunately take into account the fact that establishing fish farms in our coastal waters will "attract" fish diseases that have not occurred here before, in worst

cases diseases of the VHS type. Increasing fish farming operations assume at the same time that sales are secured with the opening up of export markets, and the occurrence of such diseases would put a temporary or permanent end to fish sales to many countries.

It should also be remembered that, so far, we do not have any clear idea of how diseases spread from cultured fish into fish that has grown in nature and vice versa.

These problems are not mentioned in the report of the Committee on the Environmental Impact of Fish Farming at all. Our preparedness to treat diseases occurring in fish farming is currently fairly weak. Basic research in the field, particularly on infectious fish diseases, is therefore badly needed.

3.2. Environmental effects, tolerance of water systems

The biological effects of fish farming on water have primarily been studied in the inland water areas and pond farms of Central Europe and Denmark. The coastal waters of the Baltic Sea area are of a completely different biotype, which is why the research results of other areas cannot generally be applied to these waters.

A thorough study is therefore needed, to find out more clearly what effects are manifesting in fish farming in different circumstances. Significant work has already been done in places such as the archipelago of Turku where the effects of fish farming on the water system are being monitored. It is nevertheless important to study the impact range because water pollution control districts are claiming that the size of the facility is crucial in terms of the environmental effects. 338

The facility size has both practical and theoretical significance. The objective of SYSTEMS ECOLOGY has been to learn enough about the functions of the ecosystem to be able to set tolerance limits on different materials. Technoadministrative interests have made themselves felt in the background: "safe" tolerance limits and direct rules for the "manipulation" and control of harmful environmental effects could be issued on the basis of these studies. Some researchers are currently of the opinion that systems ecology is in a crisis situation. The belief that it is possible to find these "safe tolerances" seems to be rapidly weakening (5). This theoretical discussion has many practical results: there is a slight possibility to successfully control and direct large-scale production units with the help of applied ecological know-how, if research does simply not know enough to make such guidance possible. It can thus be said that today's ecology yields strong evidence which shows how narrow the concept of large-scale fish farming, carried out according to "scientific methods", is (cf. above report of the Committee on the Environmental Impact and dissenting opinions associated with it). Basic research in this field improves the climate of debate for the benefit of environmental policy solutions in the fish farming field.

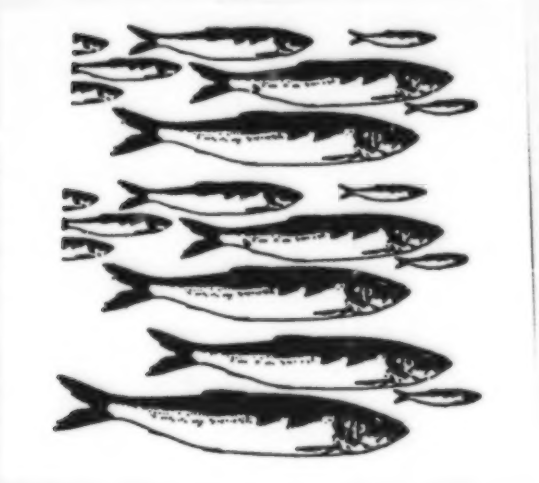
The ecological sector will have general objectives such as the following:

- how to adapt a new industry based on biological production to the natural ecosystem of the archipelago and to human ecology, taking into account all stages of the production cycle of fish farming.

- to combine, in the form of input-output models, the ratio of imported energy and nutrients (dry feed, fuel, electricity, raw materials, transportation, etc.) and productive resources occurring in the archipelago (wet feed such as fish and gutting refu e, labour), and to

proportion these to the production with the help of energy-ecological and also economical terms, i.e. output in the form of fish produced and different surpluses (fertilization of the water area, stratification, diseased and dead fish, removed material, etc).

- based on the above, to make comparisons between traditional archipelagic industries based on solar energy (such as traditional fishing, trawler fishing) and new industrial sectors that are primarily based on the energy/nutrients produced (fish farming, green-house cultivation, fur farms).



4. SOCIAL PART-PROJECTS

4.1. Structural change in the fishing industry

As expressed above, the entire fishing industry can be expected to undergo a rapid change because of the spreading of fish farming. The structural change may lead to considerable changes in prices, which may result in corresponding marketing problems with associated consequences for the population living on fishing. Previous studies have shown that

the benefit created by a new technology is distributed fairly unevenly between those who work with the old technology and those working with the new one. This has an effect on the employment situation and on earnings. The new technology also has the effect that training and new applications are needed. Traditional knowledge has only marginal importance to the operations of the new technology. This is conspicuous, if the industry producing dry feed is included.

A "social sponsor" or an interest group is needed if the new technology is to be put to use. While on the subject of fish farming, it is useful to bring up the question of its social sponsor. 339

4.2. Administrative problems associated with environmental protection

An ecological transition period leads to a situation where an increasingly large part of nature is subjected to human needs and adapted to serve production organized by man. At the same time that man begins to exploit an increasingly largerpart of nature, it becomes more important to have some kind of a control system so that the effect could be kept within suitable limits. This system of norms may assume different forms. It may be a purely administrative system, which is formally based on scientific findings about nature, or it may be a system of norms internalized by the culture, which is based on factors such as historical "folk" experience and knowledge.

An important question of administrative reseach is to study in this connection how different groups express "nature's interests". Nature does not speak for itself, so that different layers and interest groups of society must give voice to its interests. The concept of "nature" is thus historically determined. The very fact that nature is both the foundation of all life on earth and that it at the same time has very

weak "general interests" expressed by different quarters of society, make environmental administration a very important field of reasearch. "Nature's interests" formulated by different quarters can be studied in concrete cases only. Water pollution control associated with fish farming constitutes a concrete example of a situation where the above questions can be studied.

4.3. Regulation of production and structures of enterprises

It seems very probable that the expansion of fish farming will result in overproduction problems, at least in the short term. A proposal for the regulation of fish farming production already exists for legislative purposes. It is in this connection important to prepare a summary of experiences gained from a system of production regulation applied to the agricultural sector, which also has had the objective of supporting family enterprises and restricting the production of large units. Some arguments of environmental protection are sometimes easily confused with certain types of arguments applying to social development in such production regulation. } *)

*) Last sentence incomplete in original

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1. Report of the Committee on the Environmental Impact of Fish Farming. Committee Report 1982:12.

2. The concept borrowed from: [See original].

3. [See original].

4. Some Scandinavian sources:

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Wilhelm Agrell: Technological awakening. Liber 1980. Lars Ingelstam: Technological policy. Tiden 1978.

5. See for instance Christensen: Collapse of systems ecology. Natur och Samhalle [Nature and Society], No. 29: 1982, and discussion that has taken place in the magazine Niche in recent years.

6. See Charles Edqvist: Technology, organization and society. Lund.

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4. Eräitä pohjoismaisia lähteitä:

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5. Katso esim. Christensen: Systemökologiens sammenbrud. Natur och Samhälle numero 29: 1982 sekä Niche-aikakauslehdessä viime vuosien aikana käytyä keskustelua.

6. Katso Charles Edqvist: Teknik, organisation och samhälle. Lund. □